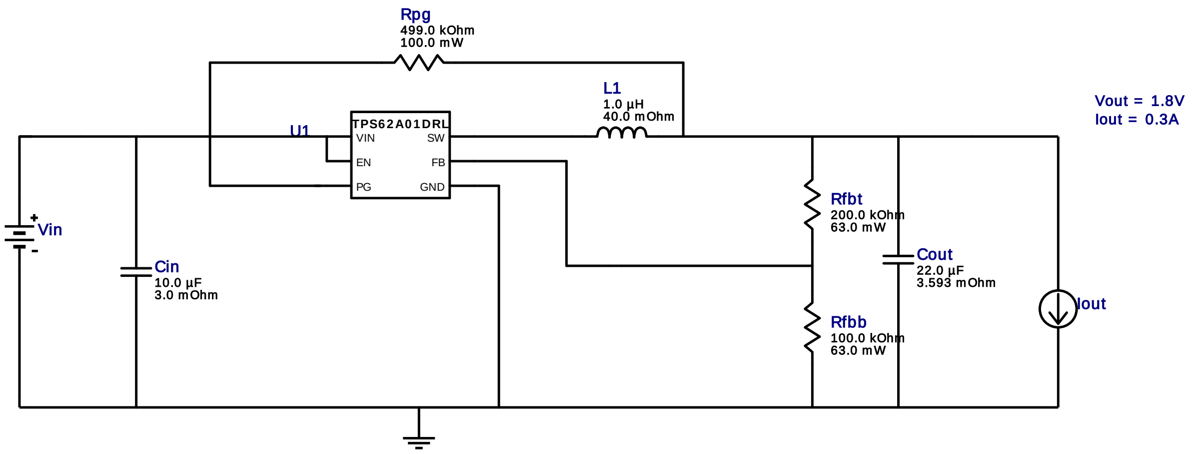
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 3.0V
VinMax = 3.6V
Vout = 1.8V
Iout = 0.3A

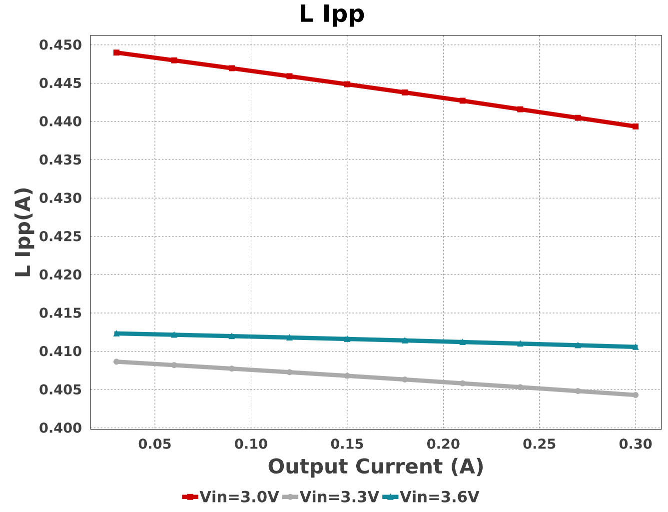
Device = TPS62A01DRL
Topology = Buck
Created = 2025-03-05 09:22:47.188
BOM Cost = $0.40
BOM Count = 7
Total Pd = 0.03W

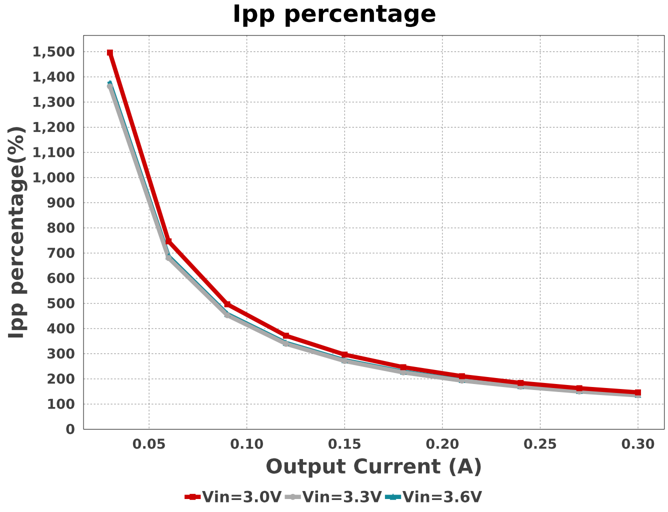
Design : 40 TPS62A01DRL
TPS62A01DRL 3V-3.6V to 1.80V @ 0.3A

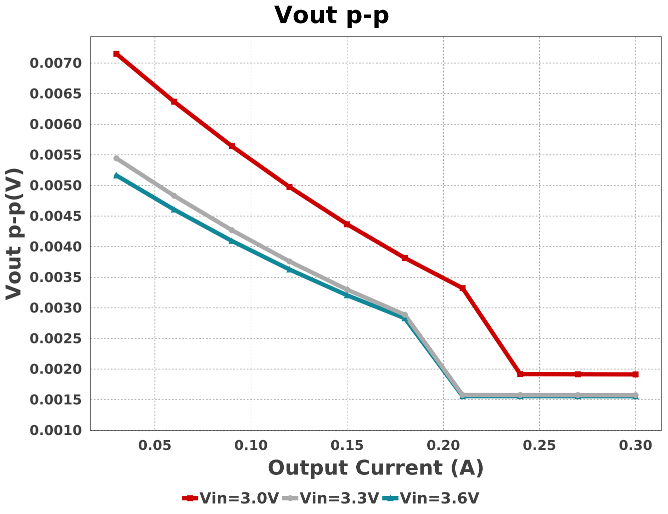


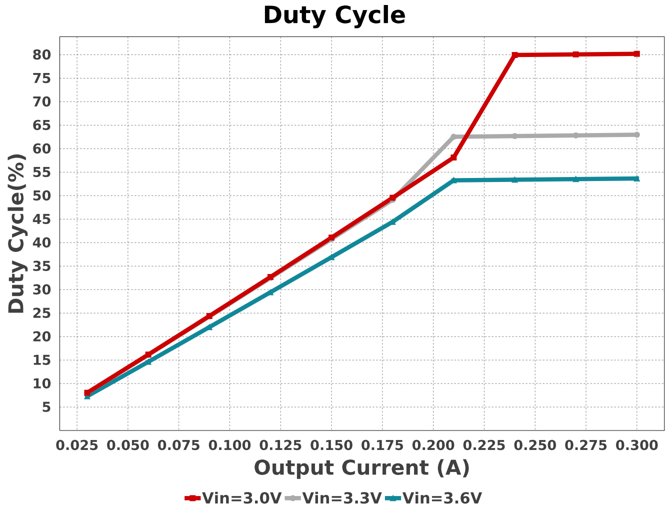
Electrical BOM

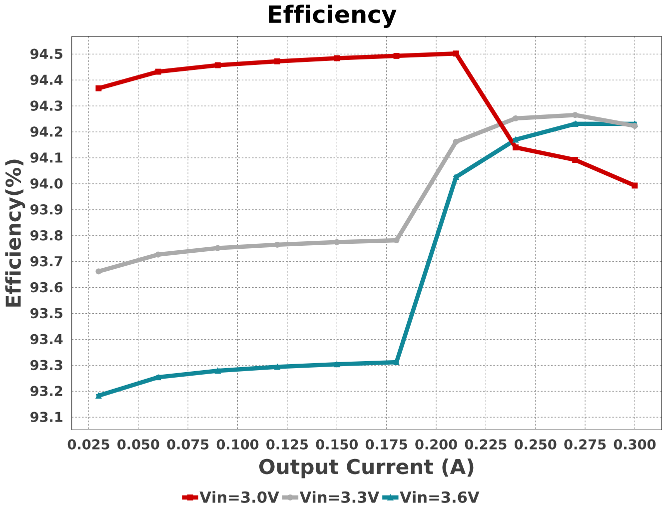
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	1	$0.03	0805 7 mm^2
Cout	MuRata	GRM31CR71A226KE15L Series= X7R	Cap= 22.0 uF ESR= 3.593 mOhm VDC= 10.0 V IRMS= 3.5332 A	1	$0.12	1206_190 11 mm^2
L1	MuRata Toko	DFE252012F-1R0M=P2	L= 1.0 µH 40.0 mOhm	1	$0.13	DFE252012F 10 mm^2
Rfbb	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbt	Vishay-Dale	CRCW0402200KFKED Series= CRCW..e3	Res= 200.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rpg	Vishay-Dale	CRCW0603499KFKEA Series= CRCW..e3	Res= 499.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
U1	Texas Instruments	TPS62A01DRL	Switcher	1	$0.09	DRL0006A 7 mm^2

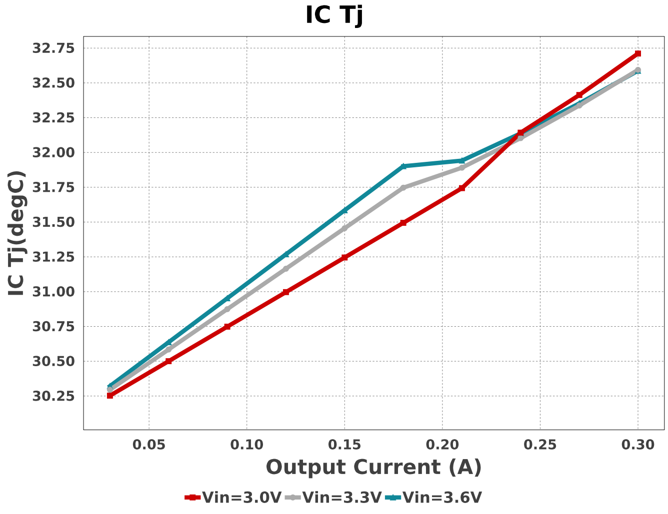

L Ipp
L Ipp(A)
0.450
0.445
0.440
0.435
0.430
0.425
0.420
0.415
0.410
0.405
0.400
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V


Ipp percentage
Ipp percentage(%)
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V

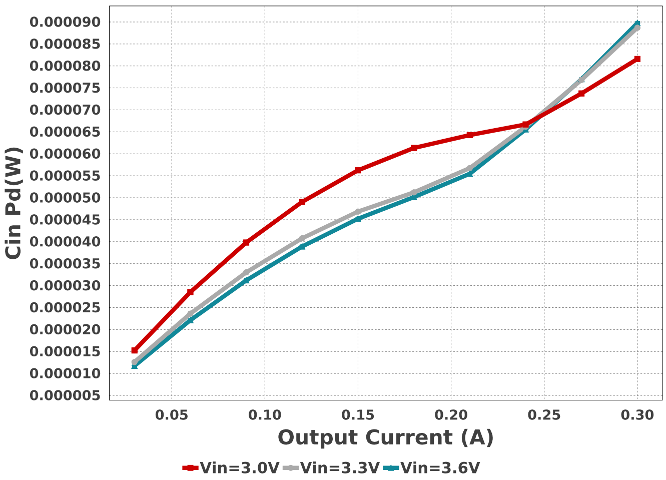

Vout p-p
Vout p-p(V)
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V


Duty Cycle
Duty Cycle(%)
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.250
0.275
0.300
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V

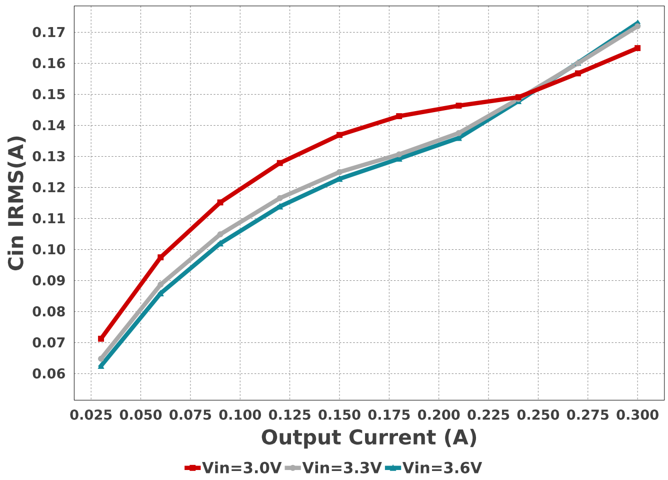

Efficiency
Efficiency(%)
94.5
94.4
94.3
94.2
94.1
94.0
93.9
93.8
93.7
93.6
93.5
93.4
93.3
93.2
93.1
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.250
0.275
0.300
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V


IC Tj
IC Tj(degC)
32.75
32.50
32.25
32.00
31.75
31.50
31.25
31.00
30.75
30.50
30.25
0.05
0.10
0.15
0.20
0.25
0.30
Output Current (A)
Vin=3.0V
Vin=3.3V
Vin=3.6V

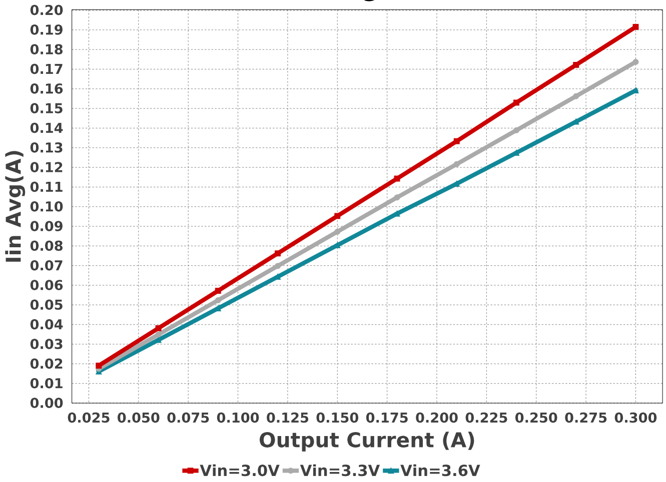
Cin Pd



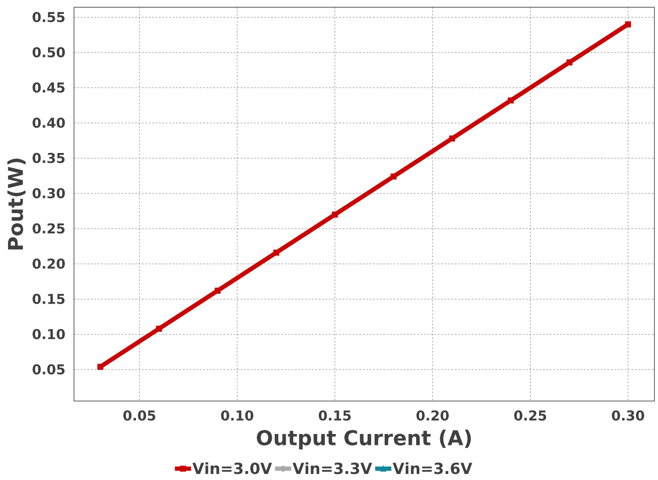
Cin IRMS



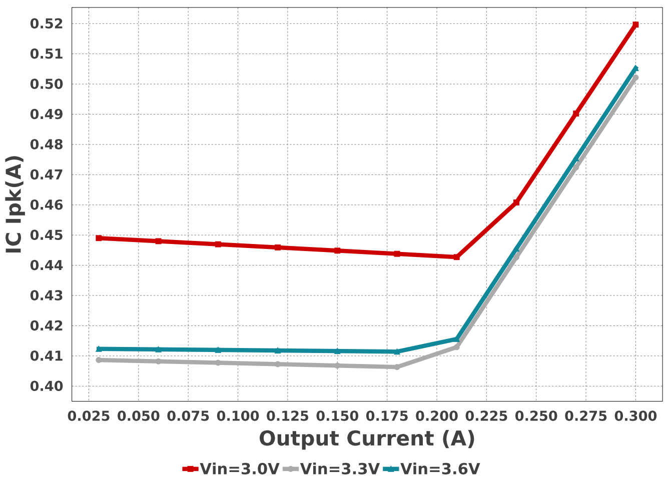
Iin Avg



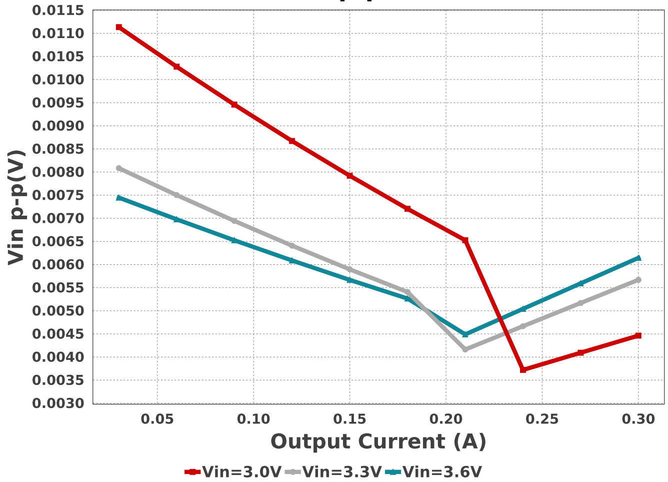
Pout



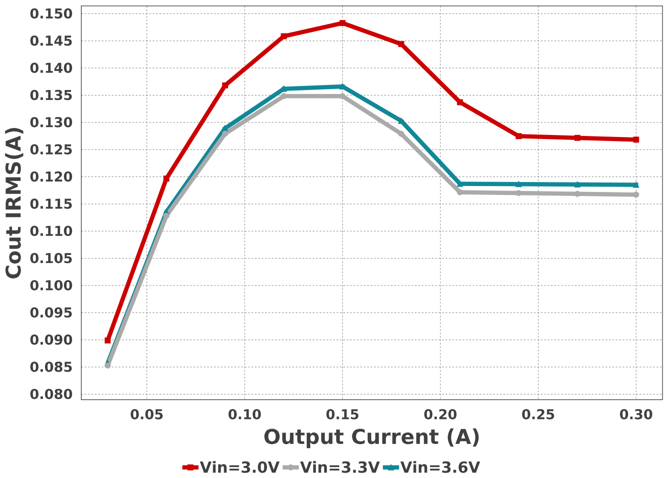
IC Ipk



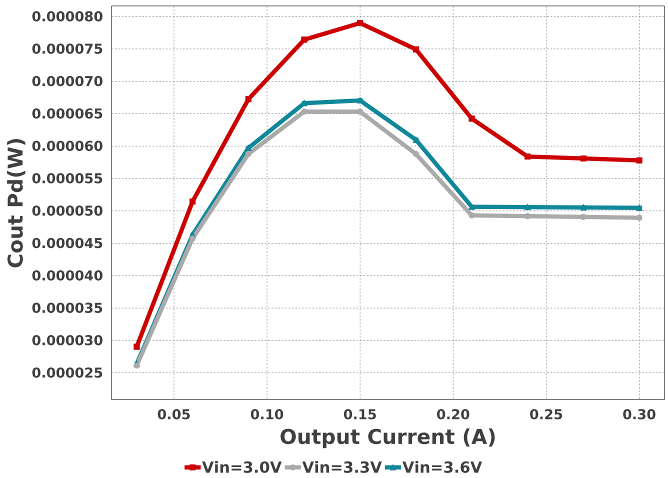
Vin p-p



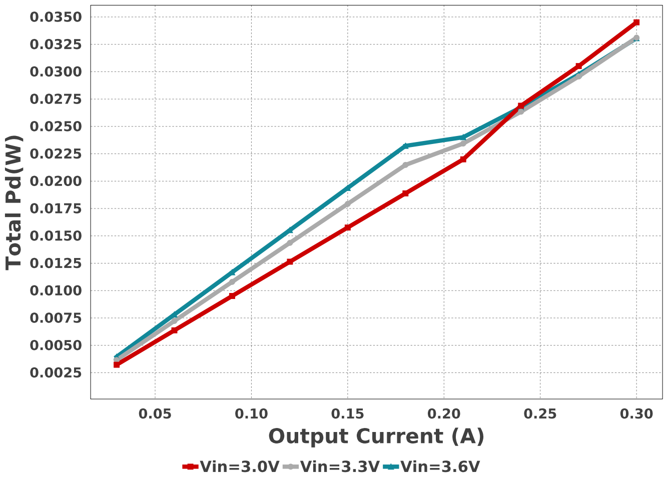
Cout IRMS



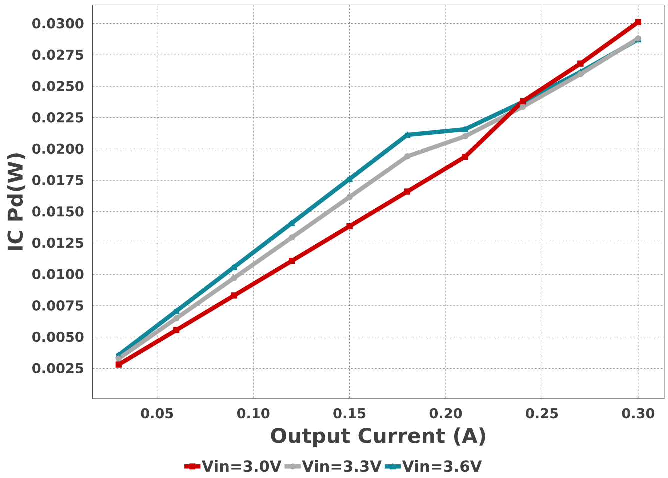
Cout Pd



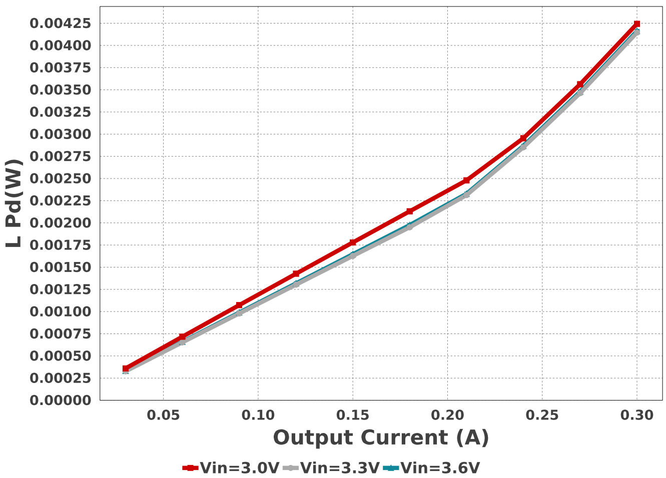
Total Pd



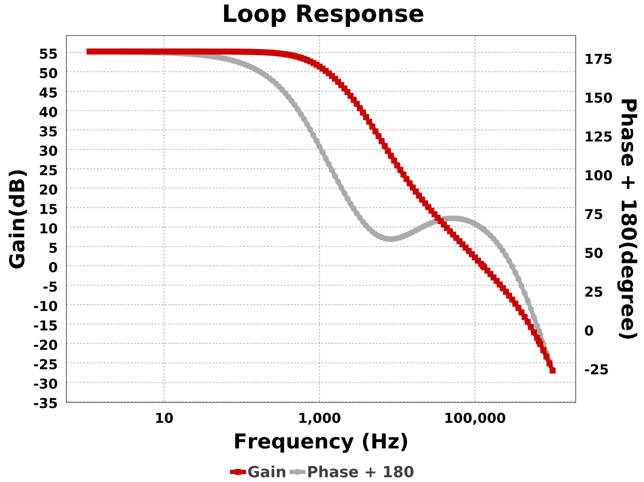
IC Pd

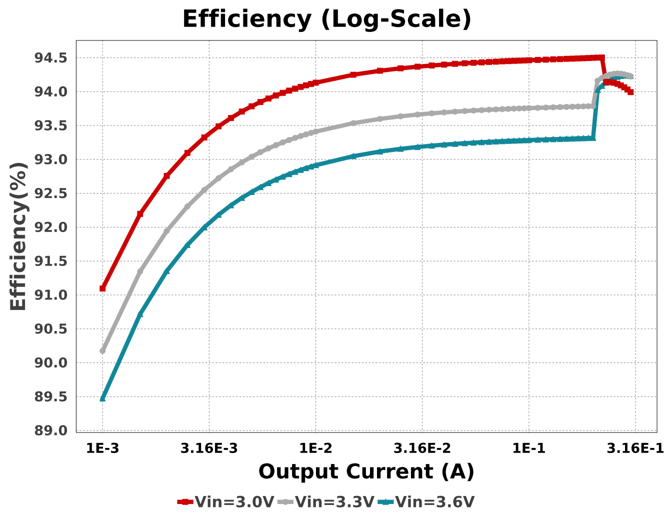


L Pd



Loop Response





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	172.965 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	89.751 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	118.523 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	50.473 µW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	505.287 mA	IC	Peak switch current in IC
6.	IC Pd	28.744 mW	IC	IC power dissipation
7.	IC Tj	32.587 degC	IC	IC junction temperature
8.	IC Tolerance	6.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA Effective	157.3 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	159.18 mA	IC	Average input current
11.	Ipp percentage	136.858 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
12.	L Ipp	410.574 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	4.162 mW	Inductor	Inductor power dissipation
14.	Cin Pd	89.751 µW	Power	Input capacitor power dissipation
15.	Cout Pd	50.473 µW	Power	Output capacitor power dissipation
16.	IC Pd	28.744 mW	Power	IC power dissipation
17.	L Pd	4.162 mW	Power	Inductor power dissipation
18.	Total Pd	33.059 mW	Power	Total Power Dissipation
19.	BOM Count	7	System Information	Total Design BOM count
20.	Cross Freq	126.701 kHz	System Information	Bode plot crossover frequency
21.	Duty Cycle	53.654 %	System Information	Duty cycle
22.	Efficiency	94.231 %	System Information	Steady state efficiency
23.	FootPrint	46.0 mm^2	System Information	Total Foot Print Area of BOM components
24.	Frequency	2.283 MHz	System Information	Switching frequency
25.	Gain Marg	-19.441 dB	System Information	Bode Plot Gain Margin
26.	Iout	300.0 mA	System Information	Iout operating point
27.	Low Freq Gain	55.217 dB	System Information	Gain at 1Hz
28.	Mode	CCM	System Information	Conduction Mode
29.	Phase Marg	65.628 deg	System Information	Bode Plot Phase Margin
30.	Pout	540.0 mW	System Information	Total output power
31.	Total BOM	$0.4	System Information	Total BOM Cost
32.	Vin	3.6 V	System Information	Vin operating point
33.	Vin p-p	6.144 mV	System Information	Peak-to-peak input voltage
34.	Vout	1.8 V	System Information	Operational Output Voltage

#	Name	Value	Category	Description
35.	Vout Actual	1.8 V	System Information	Vout Actual calculated based on selected voltage divider resistors
36.	Vout Tolerance	2.36 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
37.	Vout p-p	1.556 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	300.0 m	Maximum Output Current
VinMax	3.6	Maximum input voltage
VinMin	3.0	Minimum input voltage
Vout	1.8	Output Voltage
base_pn	TPS62A01	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

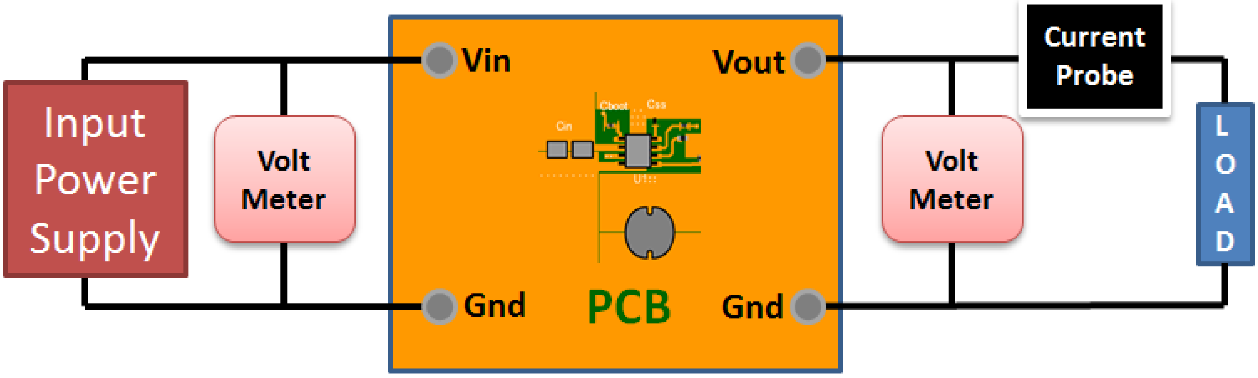
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 3.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. Master key : 27AFC3A06A218B6F8EA41ED3B4C0DDB7[v1]

2. **TPS62A01** Product Folder : http://www.ti.com/product/TPS62A01 : contains the data sheet and other resources.

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